

The Babcock & Wilcox Company

1867-1967

A Century of Progress

M. NIELSEN





"Were American Newcomen to do naught else, our work is well done if we succeed in sharing with America a strengthened inspiration to continue the struggle towards a nobler Civilization—through wider knowledge and understanding of the hopes, ambitions, and deeds of leaders in the past who have upheld Civilization's material progress. As we look backward, let us look forward."

—CHARLES PENROSE

(1886-1958)

Senior Vice-President for North America

The Newcomen Society

for the study of the history of

Engineering and Technology

(1923-1957)

Chairman for North America

(1958)



This statement, crystallizing a broad purpose of the Society, was first read at the Newcomen Meeting at New York World's Fair on August 5, 1939, when American Newcomen were guests of The British Government

"Actorum Memores simul affectamus Agenda"

THE BABCOCK & WILCOX COMPANY

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A Century of Progress

An Address at New York

AMERICAN NEWCOMEN, *through the years, has honored numerous important corporate organizations of various natures both in the United States of America and in Canada, as well as honoring the lives and work and contributions of those who founded and those who carried forward these enterprises. Such a Newcomen manuscript is this, being the one hundred year history of an internationally known, widely diversified organization whose manifold contributions have been of high order, important both in wartime and in peace.*



“There are many ways for a company to grow. The one we have found best for Babcock & Wilcox is to apply our accumulated knowledge to the solution of new and important problems. In the process, we have discovered that there are many things we did not know, but when the task has been finished, we have usually broken through into new areas that offer rich opportunities for development.

—M. NIELSEN



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M. NIELSEN

MEMBER OF THE NEWCOMEN SOCIETY
CHAIRMAN AND PRESIDENT
THE BABCOCK & WILCOX COMPANY
NEW YORK



THE NEWCOMEN SOCIETY IN NORTH AMERICA
NEW YORK DOWNINGTOWN PRINCETON PORTLAND

1967

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*The Newcomen Society, as a body,
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*This Newcomen Address, dealing with the
history of The Babcock & Wilcox Company,
was delivered at a National Newcomen Din-
ner of The Newcomen Society in North
America, held in the Hotel Pierre, at New
York, N.Y., U.S.A., when Mr. M. Nielsen
was the guest of honor and speaker,
on February 16, 1967*



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INTRODUCTION OF MR. NIELSEN AT NEW YORK ON
FEBRUARY 16, 1967, BY CHARLES PENROSE, JR., PRESI-
DENT OF THE NEWCOMEN SOCIETY IN NORTH AMERICA

My fellow members of Newcomen:

WE HONOR here this evening, during its centennial year, a great American enterprise which has contributed significantly to economic productivity both at home and abroad. From the partnership formed in 1867 by George Babcock and Stephen Wilcox to manufacture a safety water-tube boiler under a patent issued to them in that year, this organization has grown into a highly-diversified capital goods firm producing a remarkable spectrum of products. The fact of the matter is The Babcock & Wilcox Company has a long-established and well-deserved reputation for excellence.

A pleasure which never palls for me is to spend time in our Society's Thomas Newcomen Memorial Library in Steam and its adjoining Newcomen Museum in Steam, both located on the Society's grounds near Downingtown, Pennsylvania. Included in our collection of over 2,500 volumes and trade catalogues are a number of highly interesting B&W publications. For instance: "STEAM—Its Generation and Use." I understand the first edition of that publication is dated November 1875 and that the latest printing of the 37th edition is now in preparation. I wonder how many other technical books have stayed alive for so many years!

Our Speaker this evening—the distinguished Chairman and President of Babcock & Wilcox—was born in Belden, Nebraska in 1904. He joined Babcock & Wilcox in 1924 and was assigned to the boiler erection department in the Chicago district. In 1937, he was appointed District Erector for the Cincinnati area and two years later was transferred to the Marine Department as Superintendent of Marine Erection. When one considers that of approximately 5,400 major steam-powered combat and merchant vessels constructed from 1942 to the end of World War II, over 4,100 were equipped with boilers designed by Babcock & Wilcox, it can readily be seen that our Speaker had his hands full, to put it

lightly! The executive ability he demonstrated in that difficult assignment contributed to his steady rise in the Company. He was elected vice president in 1953, a director in 1954, and executive vice president in 1955.

He became President in 1957 and Chairman in 1965, remaining as Chief Executive Officer.

During his years as Chief Executive Officer, he has directed a major capital investment program of modernization, integration and planned diversification. These improvements have tremendously strengthened the Company's competitive position in the many expanding areas it serves.

His contributions to the advancement of business and industry have brought him honorary degrees from Geneva College, Beaver Falls, Pennsylvania (D.Sc.) and from Mount Union College, Alliance, Ohio (LL.D.).

In appreciation of his contributions to strengthening relations between the United States and Italy, the rank of "Knight of the Order of Merit" of the Italian Republic was bestowed upon him in 1966.

In addition to serving as a director of B&W and its various subsidiaries here and abroad, he serves as a Trustee or Director of The Bank of New York, Atlantic Mutual Insurance Company, The American Iron and Steel Institute, Centennial Insurance Company, The Worthington Corporation, Machinery and Allied Products Institute, and The Atlantic Companies.

His deep interest in furthering the cause of education is reflected in his activity as a Life Trustee of Carnegie Institute of Technology, and Trustee at Large of the Independent College Funds of America, Inc.

His memberships include The American Bureau of Shipping, American Society of Naval Engineers, American Society of Mechanical Engineers, National Industrial Conference Board, and The Society of Naval Architects and Marine Engineers.

Gentlemen, it is a great pleasure to present to you, the Chairman and President of The Babcock & Wilcox Company, Mr. M. Nielsen.

My fellow members of Newcomen:

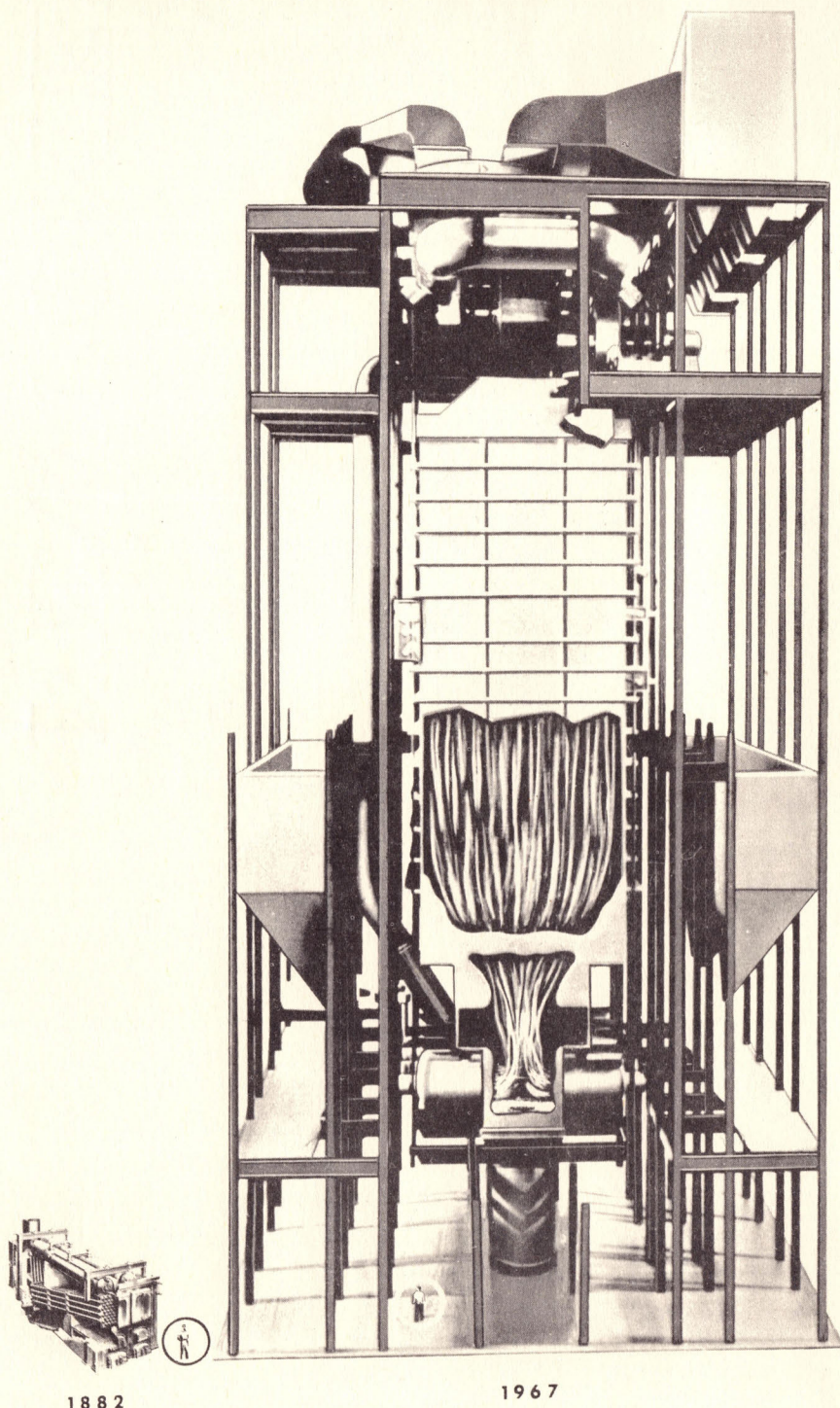
IT would be an honor to appear before you in any year, but The Babcock & Wilcox Company is particularly happy to be honored by the Newcomen Society in North America during this special year in our history—our hundredth anniversary.

We feel that our appearance is also especially appropriate because Thomas Newcomen, whose memory is perpetuated by this society, was a boilermaker as well as a builder of engines.

Newcomen and the other pioneers who developed the steam engine were men with probing minds who worked on a most important problem: How to generate steam and put it to work for man's benefit. They opened a new era—and it is one that is still being explored today: Whatever the initial source of heat, steam is still an indispensable medium for converting a large share of it into useful work.

The early developers of steam engines and boilers were not simply inspired mechanics making discoveries more or less by chance. They had a good knowledge of their subject and each advance in pressure, temperature, and combustion was based on a conscious search for greater efficiency and larger power output from smaller machines. This led to a steady improvement in engines. Steam boilers also improved, but reached a plateau in the mid-nineteenth century that threatened future progress: The fire-tube boiler—the type commonly in use—was inherently limited in pressure, temperature, unit output, and safety. As industrial America sought to push its engines beyond their limits, fire-tube boiler explosions were frequent and tragic.

Many men worked on the solution of this problem—which called for the development of a safe water-tube boiler—and many ingenious but impractical solutions were suggested. It was Stephen Wilcox, however, who applied his knowledge of water circulation theory to find the proper answer. This resulted in the Wilcox Patent of 1856. An improved model was patented in 1867, at which time George Babcock and Stephen Wilcox formed their partnership.



Technological progress in boiler design is dramatized by comparison of one of the B&W units for Edison's Pearl Street Station—built in 1882—with a modern Universal Pressure steam generator. A central station boiler now consumes as much as 10,500 tons of coal per day and can generate enough power to supply all the electrical needs of many millions of people.

The water-tube boiler was an open-ended invention—its development has been continuous to this day—and shows no signs of stopping. The most advanced nuclear steam generating systems now being built incorporate water-tube boilers.

The B&W boiler had no inherent limitations on pressure, temperature, and unit output. It literally took the lid off steam engine development. As a matter of fact, the reciprocating engine became so large that it was in essence a technological dinosaur and was soon displaced by the steam turbine—a compact prime mover which, as developed, has practically no limit as to capacity.

As a result of the good acceptance of the B&W boiler, the partnership prospered and it was incorporated in 1881. In that same year a branch was established in Scotland to expand the Company's business in Europe. The growth at home and abroad was so rapid that the financing of operations soon became a problem. It was therefore decided in 1891 to sell the British branch and a separate company was formed with British capital. The only connection between the two companies is by means of technical interchange agreements. B&W U.S.A. competes throughout the world with B&W Limited and its affiliates.

The advent of central stations for generating electricity opened a vast market for B&W boilers. In 1881, four B&W units were installed in the first central station in America—the Brush Electric Light Company plant in Philadelphia. When Edison built his first generating station in 1882, he installed four B&W header-type boilers. We are very proud of a note he wrote to a friend, who was about to buy a boiler, in which he stated that the B&W boiler "... is the best boiler God has permitted man yet to make."

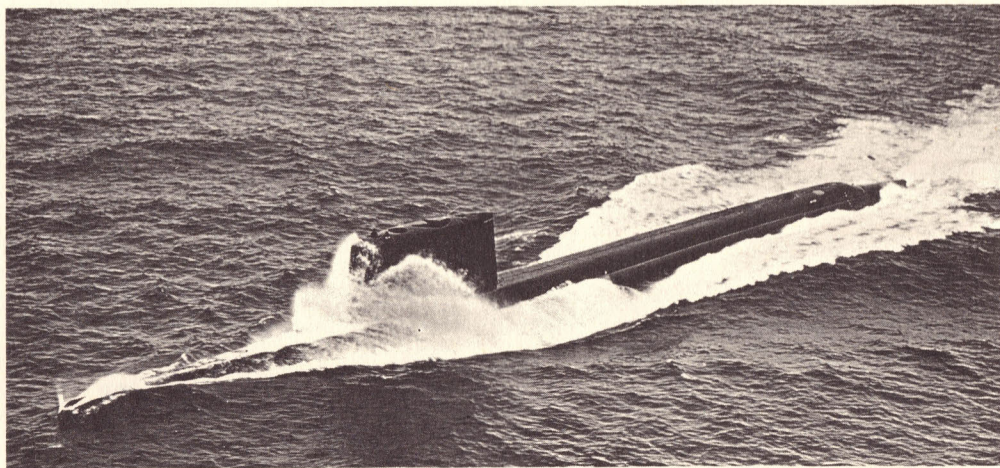
The B&W installations in these pioneer generating stations began an association between our Company and the electric utility industry which has grown steadily stronger over the years.

Industry in general also benefited from the water-tube boiler. Wherever steam was needed—power generation, sugar refining, petroleum processing, chemical manufacturing, steelmaking, the pulp and paper industry—it has been used safely and efficiently in large quantities and at the desired pressures and temperatures.

The American Navy and Merchant Marine also found the B&W boiler an economical means of achieving more efficient power in less space. Because of the Company's understanding of the problems of naval and merchant ship operations, B&W's designs have been selected for a large share of the vessels built in the United States in the past 60 years. We supplied over 90 per cent of the boilers for all combat ships in World War II. In addition, B&W destroyer boiler designs were given to two other companies so that the units they produced would be identical with ours and repair and spare parts could be used interchangeably.

Seventy-five per cent of all merchant ships built in that war were equipped with boilers designed by B&W. The Company built the majority of these boilers. It also gave its detail drawings to eleven competitors, most of whom had never built a marine boiler before. This greatly speeded construction of the wartime emergency fleet and also insured that repair and spare parts would be identical for all such vessels.

The close association with new developments for the Navy and Merchant Marine continues down to the present day. B&W is the prime supplier of nuclear steam generating equipment for the nuclear Navy. We designed and built the nuclear plant for the



As a leader in designing and building boilers for naval and merchant vessels, B&W has been in the forefront of developments for nuclear propulsion. It is a prime supplier to the modern nuclear Navy and designed and built the highly successful nuclear plant for the N. S. SAVANNAH—the world's first atomic-powered merchant ship.

world's first atomic-powered merchant ship—the N. S. SAVANNAH—which has compiled an excellent record for nuclear performance, safety and reliability during several years of scheduled operations on major transoceanic routes.

I have sketched for you very broadly the significant role played by the B&W water-tube boiler invention in the power, industrial and marine fields. However, it is not my intention this evening to relate in detail the many individual developments the Company has made in steam generators during the past 100 years. The story has already been told at considerable length and is available in various B&W publications. What I would like to discuss is the subject of technological pioneering and its impact on the growth of our Company.

George Babcock and Stephen Wilcox were restless men, but unlike many of their contemporaries who followed Horace Greeley's advice to go west, they stayed at home and did their exploring on the technological frontier. Scarcely was the ink dry on their patent papers, when they began to improve their product:

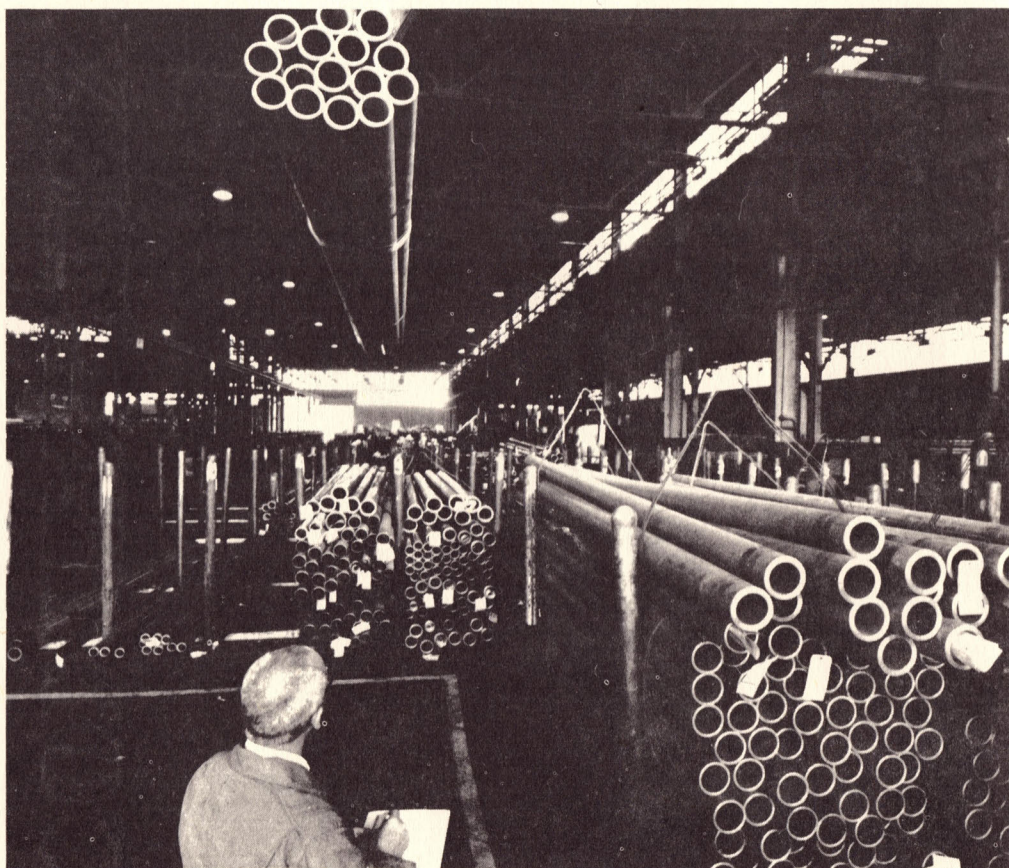
- They searched for better materials.
- They insisted on ever higher standards of workmanship.
- They constantly experimented to improve the efficiency of their designs.
- And they were always seeking ways to reduce the cost of their product.

Their motto was "There is a way to do it better." As a matter of fact, Stephen Wilcox's TWELVE RULES FOR BUILDING A PERFECT BOILER, originally published in 1875, are still valid today. With slight modification they could be used as a guide for the successful development of any engineered product.

Because of their progressive philosophy, George Babcock and Stephen Wilcox attracted men who wanted an atmosphere of freedom to think, to experiment, to improve—men who would never be content with the way things were being done because they knew the frontiers of technological progress were ever receding. That philosophy has permeated the Company, as each generation has developed successors who thought in a similar vein. The men who built B&W over the years are too many to mention in

detail, but credit is due all of them and a few should be named: Nat. W. Pratt, E. H. Bennett, E. H. Wells, W. D. Hoxie, A. G. Pratt, Alfred Iddles, all former presidents, and Isaac Harter, E. G. Bailey, and C. W. Middleton, vice presidents.

There are many ways for a company to grow. The one we have found best for B&W is to apply our accumulated knowledge to the solution of new and important problems. In the process, we have discovered that there are many things we did not know, but when the task has been finished, we have usually broken through into new areas that offer rich opportunities for development.



In the search for better boiler components, B&W acquired a tube-making facility in 1904. This has grown to be one of the world's largest suppliers of specialty alloy and steel tubing for the chemical, petroleum, automotive and many other industries.

Once the fundamental problems of boiler design were well on the road to solution, the Company found that it was having difficulty securing durable, high-quality tubes at reasonable prices. We needed a light-wall, hot-finished seamless steel tube which would provide good service and still be stronger, more reliable, and more economical than the charcoal iron tubes then in use.

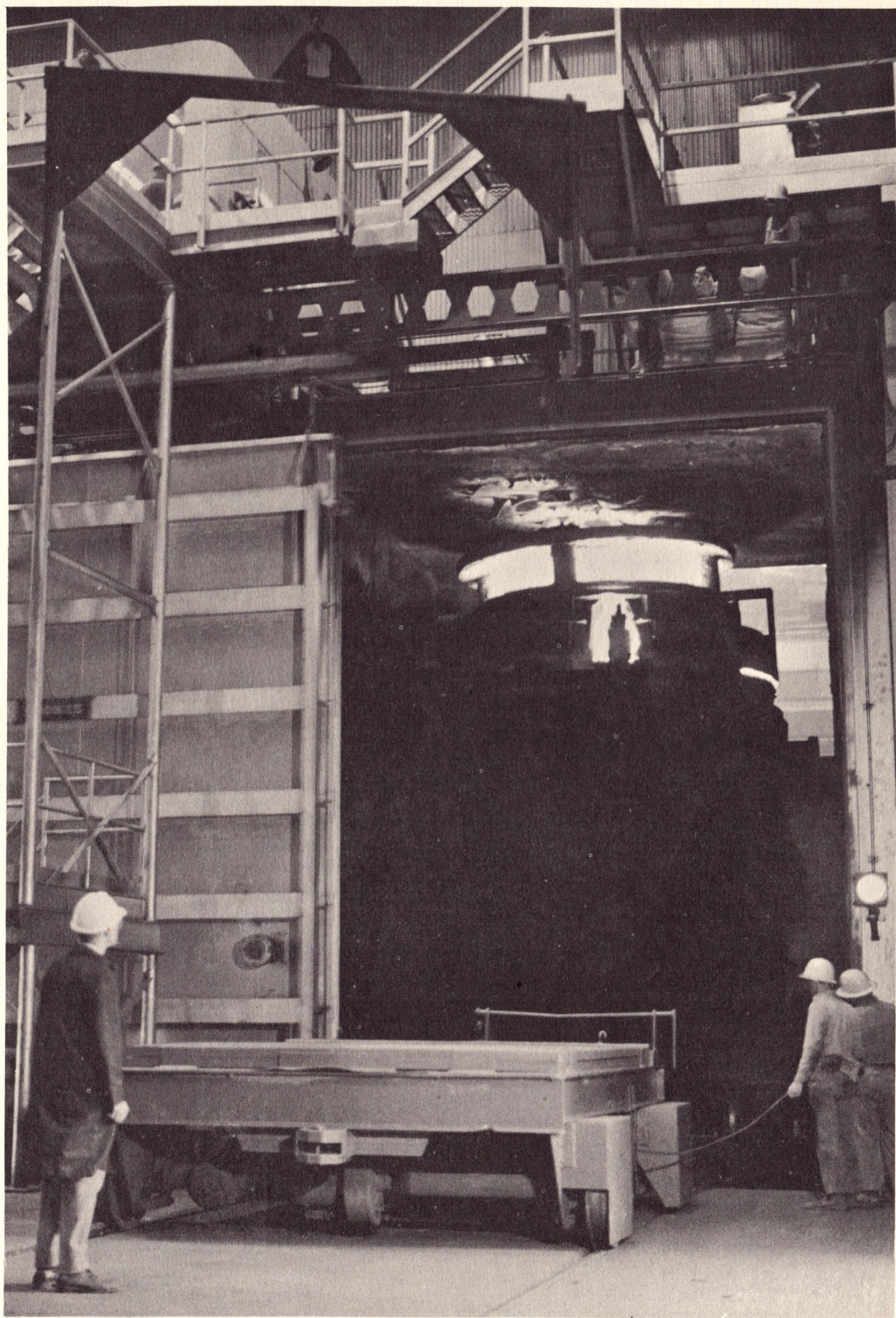
The practical answer to this problem was to make our own tubes, and, as a first step, the Pittsburgh Seamless Steel Tube Company was acquired in 1904. Its main business at that time was the manufacture of seamless tubing for bicycle frames—a far cry from tubing for boilers.

This new unit quickly experienced radical changes under the B&W philosophy of “do it better.” The tube mill at the Beaver Falls plant was revamped, existing machinery rearranged, and additional equipment installed to adapt the plant to the manufacture of high-quality boiler tubes. The operation was a success and the tubes were among the first commercial hot-finished seamless boiler tubes produced in the United States.

From this modest beginning, B&W’s participation in the tube industry has grown logically and cumulatively into its present extensive operation. The reason for this growth is not hard to find.

Fifty years ago, tubing materials and manufacturing processes were undergoing continuous improvement to withstand the higher pressures and temperatures of new boiler designs. B&W’s research in alloy and stainless steels for this purpose developed tubes that met not only the requirements of the boiler industry but were urgently needed in the petroleum, chemical, food processing, and allied industries. As an example, by 1920 the increasing number of automobiles and the resultant demand for gasoline brought changes in the operations of the petroleum industry. The entire refining process was revised. As oil heating pressures and temperatures went up, and corrosive crudes were refined in volume, the market for B&W alloy and stainless steel tubes grew rapidly.

Because these new steels required precise control of all operations—from the initial melt through to final piercing and rolling, the Tubular Products Division decided to build its own steel mill to produce a portion of its alloy requirements. The first two electric



To insure the quality of materials used in its tubing, B&W built its own steelmaking facilities in 1942. These have undergone constant expansion and the Company is now a significant producer of specialty steels. A recent important advance shown above was the installation of vacuum-degassing facilities to produce ultra-clean steel.

furnaces were placed in operation in 1942 and their output was helpful in meeting the sharply increased demands for alloy and stainless steel created by the war.

Our steelmaking facilities have steadily expanded from that time and we are now in the midst of the latest major addition. It will raise our melting capacity to 600,000 tons per year. The expansion of our steelmaking capacity has taken place at a completely new site near Beaver Falls, Pennsylvania. Construction started in 1958 on a planned program that was originally to have covered 15 years. Growth in demand, however, has been so rapid that the program is now about 5 years ahead of schedule. The new plant includes six large electric furnaces and two vacuum degassing units as well as rolling mills and all the other appurtenances of steel production. We believe it is one of the most modern and efficient specialty steel mills in existence.

In typical B&W fashion, once we were in the business of steel-making, it was only natural for someone in the organization to insist that there was a better way to go from the molten steel to semi-finished forms such as billets and slabs. This led to the establishment of a research and development project for the continuous casting of steel. As a result of this effort, B&W in 1963 designed and built for the Roanoke Electric Steel Corporation the first commercially successful continuous casting steel plant in the United States. A large continuous casting plant is now being engineered for Republic Steel Corporation.

The Tubular Products Division took another pioneering step in 1952 when it introduced in the United States the extrusion method of fabricating alloy and stainless steel tubes and shapes. This method is rapidly gaining in importance as the demand increases for products made from high temperature alloys and exotic metals.

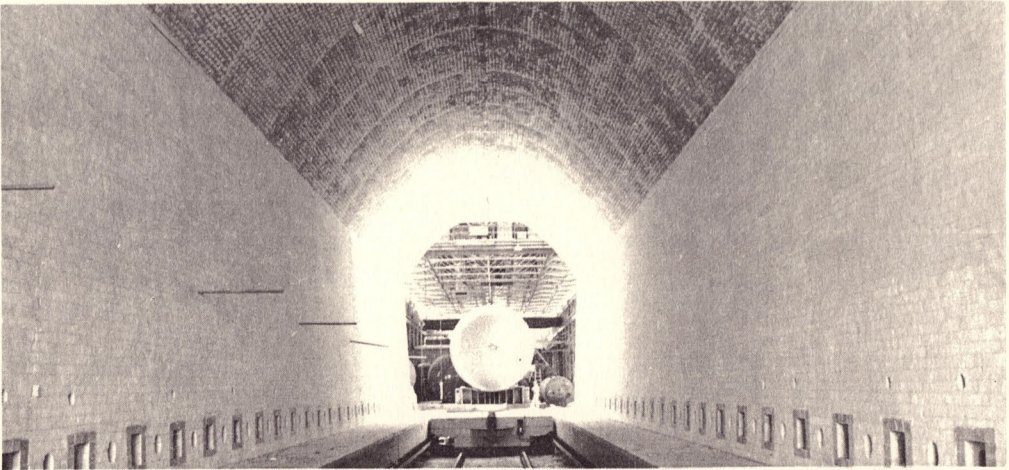
This division is today one of the largest integrated producers of specialty tubing and steel products. Only a small percentage of its output is used in steam generators or by Babcock & Wilcox. The remainder is used in a vast array of pressure and mechanical applications in practically all industries.

We feel, however, that the Tubular Products Division is only beginning to grow. New steel products—rolled rings, welding

fittings, forgings—are opening new markets, and the pressing need for more economical and durable materials will call for development of new alloys and require new and more efficient manufacturing processes.

B&W's Refractories Division—today one of the leading developers and producers of specialty refractories—grew out of the Company's determination to find a better refractory material for lining boiler furnaces. By World War I, it was apparent that further development of boiler size and rating was being limited by the quality of firebrick available. They simply would not stand up in large furnace walls at high temperatures.

Very little scientific work had been done up to that time on firebrick. Therefore, the group of outstanding young men assembled largely from within the Company to solve the problem of producing a superior refractory had to start almost from zero. They worked for several years, experimenting with materials from all over the world and finally selected kaolin as a base material. This is a white clay of a high degree of refractoriness, purity, and uniformity. The necessary mixing formulas, processing operations, and manufacturing procedures were then devised to produce a brick of the required chemical and physical properties. Their ef-



B&W refractories, originally developed to line boiler furnaces, quickly found widespread uses in the glass, steel, chemical and petroleum industries. Shown here is one of the world's largest stress-relieving furnaces lined with thousands of B&W Insulating Firebrick.

forts met with success and the commercial sale of B&W 80 Firebrick started in 1922. This was the first truly "engineered firebrick." It was called B&W 80 because it was the 80th formula tested. It was also referred to as our "Gold Brick" because of the amount of money it had taken to develop it.

Ironically, the original need for the firebrick began to disappear almost as soon as it was developed. The success of water-cooled walls greatly reduced the amount of refractories required in boiler furnaces. However, as so often happens with technological breakthroughs of this kind, many other industries were waiting for a more durable refractory, and the 80 Firebrick was soon being sold in substantial quantities to the petroleum, chemical, glass, and steelmaking industries. This led to the establishment of the Refractories Division and the construction of a plant at Augusta, Georgia, adjacent to large kaolin deposits.

The men who were successful in developing the first B&W firebrick quickly turned their attention to other refractories problems of industry in general—as distinct from boiler applications—and by 1930 they invented the first practical insulating firebrick—a development which revolutionized industrial furnace design.

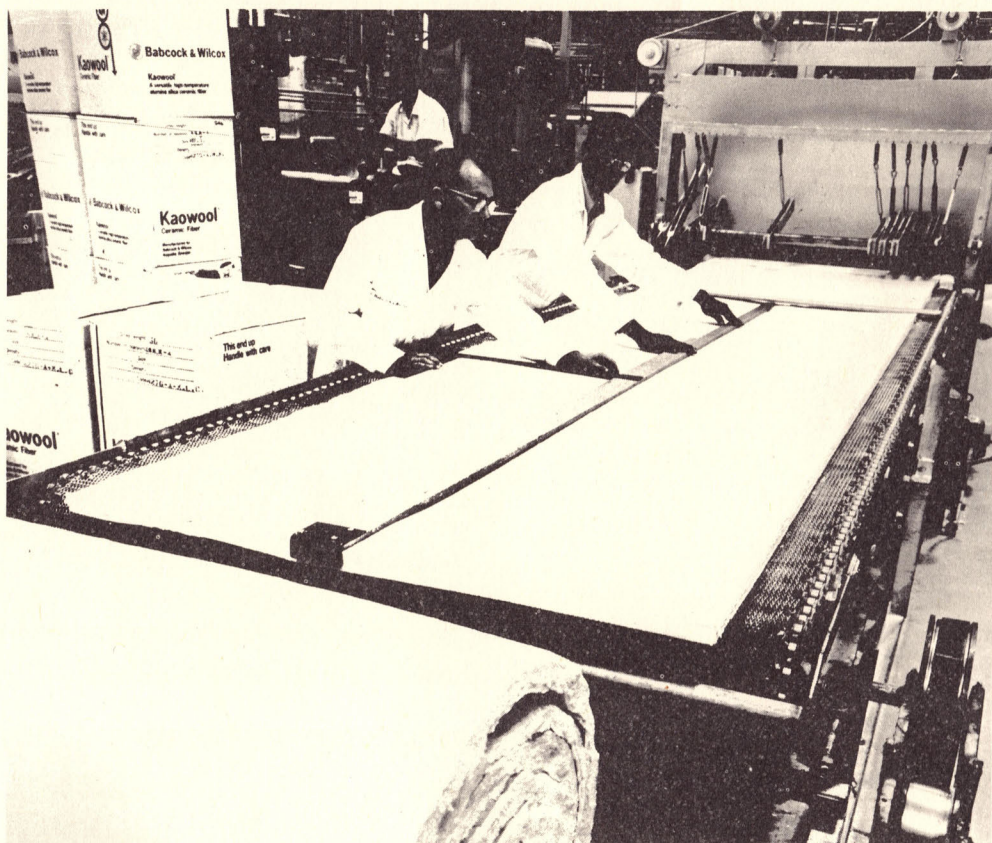
These brick weigh one-eighth to one-fourth as much as ordinary firebrick, and combine high heat resistance, excellent insulating properties, and low heat storage. They can be used directly exposed to furnace gases, and because of their high resistance to the flow of heat require no back-up insulation. Their use makes it possible to design furnaces with light, thin walls, less supporting steelwork, and lighter foundations. They save large amounts of fuel and considerably reduce cycle-time.

The metalworking, petroleum refining, and chemical processing industries have all benefited immeasurably from this great forward step in refractories.

Since then there have been many other developments, such as:—*refractory concretes*—materials which can be handled like ordinary building concrete but which will withstand temperatures up to 3000 F.

—*ceramic fibers made of clay or metallic oxides*. These are often finer than silk and can be woven, spun, or used in many other

Ceramic fibers, made from molten Kaolin clay, withstand high temperatures and are used in a variety of industrial and consumer applications. They are produced in blankets, as shown below, and in many other forms.



ways to form heat insulating products which are now being used in everything from home soldering kits to fuel-line insulation in space rockets.

—*Cerox*—high purity prefired shapes with unusual resistance to thermal shock, chemical reaction, abrasion, and erosion.

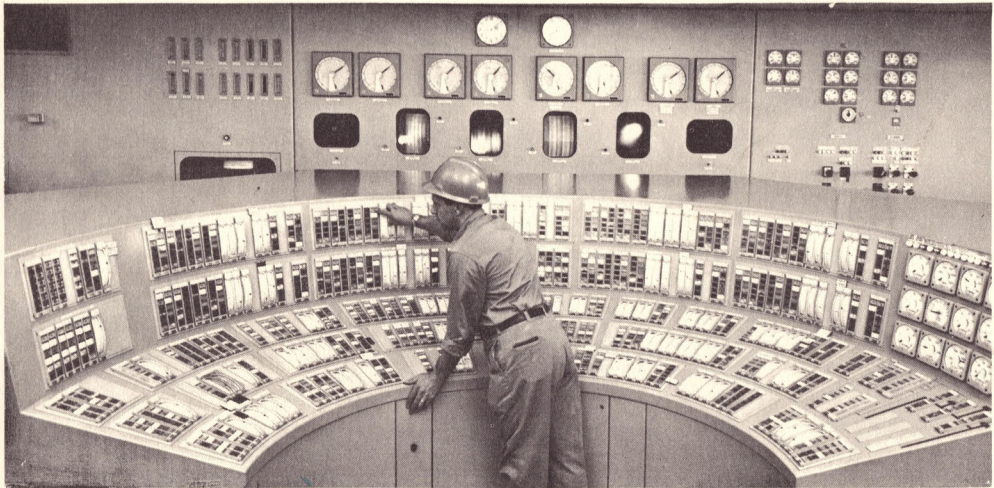
We are confident that the growth of this division will be even more rapid in the future than it has been in the past. In 1964 the division acquired its own kaolin mines. This step not only integrated its operations, but enabled the division to enter the entirely new field of supplying beneficiated clay for non-refractory applications in the chemical, rubber, paper, and paint industries. In 1965

B&W acquired Standard Refractories Limited which has, since then, twice undergone expansion. Incidentally, it is the first company to manufacture insulating firebrick in Canada.

Bailey Meter Company is in the business of conceiving, developing, and manufacturing instrumentation, controls, and automation systems for public utilities, industrial plants, and the process industries. It was incorporated in 1916 and became a B&W subsidiary in 1925.

Bailey Meter grew out of the need early in this century for more efficient and economical combustion of fuels in boiler furnaces. This required an accurate means of measuring the many factors entering into the combustion process. Since none existed, Bailey invented a line of instruments and meters which were so effective that they quickly became established as indispensable tools in the steam plant.

Automatic control was the logical step after metering, and in 1923 the first Bailey Meter combustion control was installed. This was the first automatic method of adjusting and maintaining optimum air and fuel supply to the furnace as the demand for steam increased or decreased. It was the forerunner of today's highly automated computer-operated plant with its thousands of meters,



Bailey Meter Company, founded in 1916, is a world-recognized leader in the field of instruments and computerized control and monitoring systems for the power and process industries. Shown above is the control console for a modern central station.

instruments, and control devices. Now, with a complete Bailey system, it is possible to automatically start and operate the largest steam generating plants with the push of a single button. As a result, it takes fewer people to operate today's giant steam electric plants than it did to run Edison's Pearl Street Station in 1882.

Bailey is able to manufacture all the essential components of its control systems:

- The sensing devices that tell what is happening in the process being controlled.
- The computers which absorb this data, issue orders of what is to be done, store significant factors, and compute results.
- The control equipment which adjusts operations as the computer dictates.

Bailey can supply the complete system or any component or individual instrument.

To handle the growing volume of business, Bailey Meter has had to expand several times, both in the United States and Canada. It now has plants at Cleveland and Wickliffe, Ohio, and at Montreal and Pointe-Claire, Quebec. Last year it acquired Belfab of Daytona Beach, Florida, which manufactures metallic bellows used to regulate liquid and gas flow in space vehicles and industrial processes.

Automation is still in its infancy. With its solid background in all aspects of this science, Bailey Meter will have an important part in the growth which lies ahead.

Diamond Power Specialty Corporation was founded in 1903 and acquired by B&W in 1922. It originally devoted its energies to the development of equipment for cleaning boiler heat transfer surfaces, thereby maintaining efficiency at high levels. The chemical, petroleum, and steel industries also required a means of keeping heat-absorbing equipment free of ash deposits and Diamond adapted its designs to meet their needs.

Because of their association with the power industry, Diamond's engineers soon became aware that accurate and reliable remote indicating devices were essential to enable operators to continuously observe furnace conditions and water levels. As a result,

Diamond developed the first successful industrial closed-circuit television system in the United States. These systems are now being used in many industrial and commercial applications—ranging from steelmaking to traffic control.

Diamond is today entering other growth areas such as control-rod drives for nuclear reactors and gas absorption systems to control air pollution.

Diamond has plants in the United States, Canada, England, Scotland, and Sweden.

The newest member of the B&W organization is its Automated Machine Division, consisting of W. F. & John Barnes, acquired in 1963, and Detroit Broach & Machine and Century-Detroit, both acquired in 1966.

These acquisitions were outgrowths of our interest in highly engineered production machinery and precise manufacturing techniques. Barnes is a leading producer of internals for nuclear reactors, a field requiring unusual design, engineering, and manufacturing skills. It is also a major supplier of automated mass



Diamond Power Specialty Corporation's closed circuit industrial television speeds operations and helps simplify production in steel plants and other applications where remote observation and control are desirable. Diamond, the leading supplier of cleaning equipment for heat transfer surfaces, has diversified into other areas such as electronics, gas-cleanup systems, and nuclear reactor control drives.

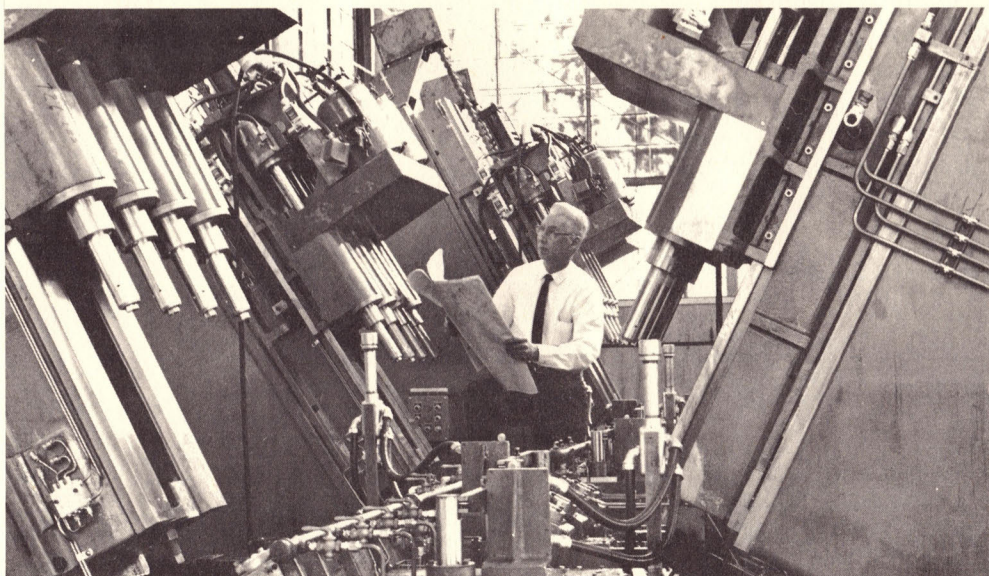
production machines, machine tools, and electric, mechanical, and hydraulic controls and systems for the automotive and other industries.

Detroit Broach manufactures broaches, broaching machines, and automatic tracer lathes for the mass-production industries.

Century-Detroit is a leading source of hydrostatic bearings, rotary tables, and similar equipment used in precision machinery.

All three companies have sound, profitable businesses with excellent growth possibilities. Combining them with the potentials existing in other B&W divisions and subsidiaries has created new opportunities for the development of the highly engineered computer-controlled machinery for the technological revolution taking place in American industry.

While B&W has been growing steadily in a great many different directions, the original business on which the Company was founded has continued to expand to meet the needs of steam users in both industrial and power generating applications. B&W's



Transfer machines for the automotive industry are one of the many products of B&W's Automated Machine Division. This newest addition to the Company is growing steadily as a producer of automated machinery and specialized tools.

Boiler and Atomic Energy Divisions can look forward with confidence to very challenging futures because it is safe to predict that steam will continue to be an indispensable working medium for generations to come.

Steam boiler design has kept pace with modern technological development. Today we can pack into one shop-assembled boiler 10 times as much steam generating capacity as existed in all four boilers in Edison's Pearl Street Station.

A modern central station boiler produces enough steam to run a 1,100,000 kilowatt turbogenerator. Its height exceeds that of a 20-story office building and it consumes 10,500 *tons* of coal per day—or about 150 carloads. Steam is generated and superheated in 350 miles of tubing and the efficiency factor for converting the heat in fuel to steam energy is approaching as near to perfection as the laws of nature allow.

When such a unit was described to one of our non-technical directors some years ago, he exclaimed: "My God, do we do that?" We do that and more too, because the end point in unit size for fossil fuel steam generators is far from having been reached. We now have designs under development capable of producing 14,000,000 pounds of steam per hour to serve a 2,000,000 kilowatt turbogenerator. That, incidentally, represents the *total* electric generating capacity installed in Denmark.

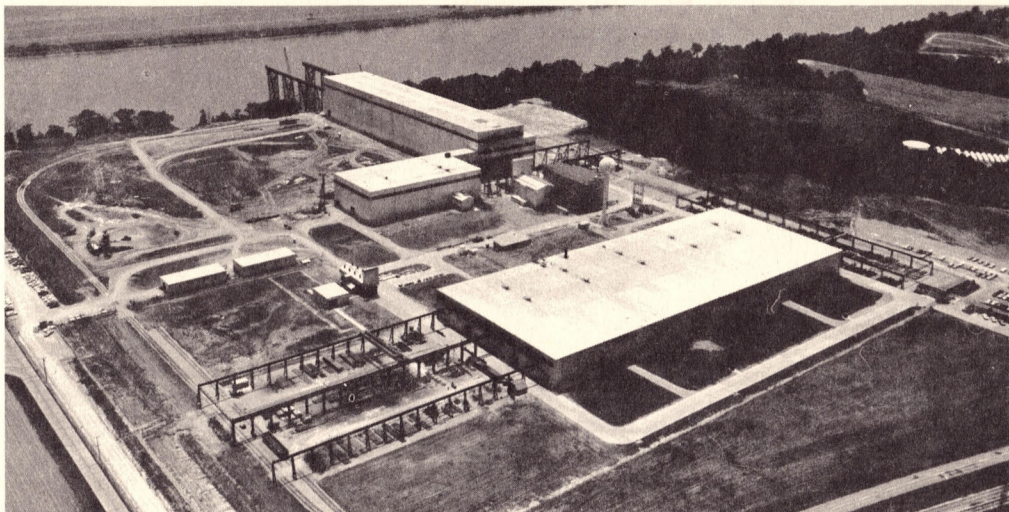
The demand for electrical power is growing at such a rate that all sources of energy will have to be used to meet it. It is therefore safe to predict that, while the use of nuclear fission is growing rapidly, it will also be necessary to use great quantities of fossil fuels into the foreseeable future.

B&W, of course, is deeply involved in the development of nuclear power generation, and has been from the inception of the Manhattan project during World War II.

B&W designed and built the nuclear steam generating system for the nation's first privately financed nuclear power station—Consolidated Edison Company's Indian Point Plant which, incidentally, was the first to be licensed by the AEC.

In 1956 the Company opened the first privately financed plant for the manufacture of fuel elements. This plant, located on a

The Company's new \$25,000,000 plant on the Ohio River at Mount Vernon, Indiana, is the most modern in existence for the fabrication of the giant pressure vessels and other components required for the rapidly growing nuclear power industry.



525-acre site near Lynchburg, Virginia, has been expanded several times to keep up with the demand for fuel elements and cores for government and commercial reactors. In 1961 a Nuclear Development Center was completed at the same location to coordinate all of B&W's nuclear fuel and core research and development work.

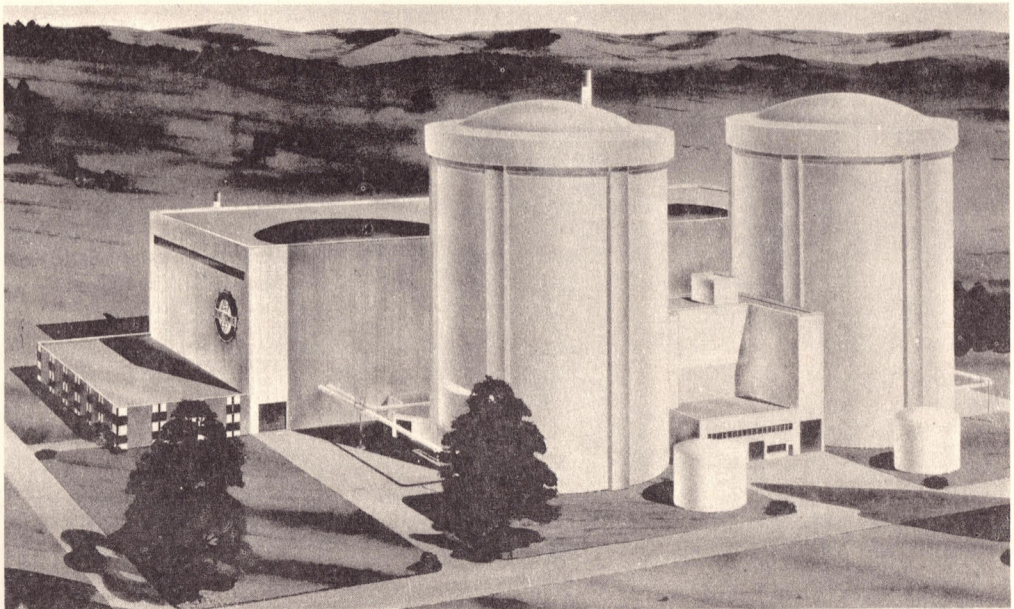
To round out the extensive nuclear facilities existing throughout the Company, we have built a completely new \$25 million pressure vessel shop on the Ohio River at Mount Vernon, Indiana—the largest of its kind in the world. It can fabricate and ship vessels weighing as much as 1,000 tons and measuring up to 150 feet long.

In July of last year B&W was selected by Duke Power to build two pressurized-water nuclear steam supply systems for that utility's Oconee Nuclear Station on Lake Keowee in South Carolina. Each reactor will serve an 840,000 kilowatt generator. In November we were awarded the contract for the nuclear steam supply system for a new 840,000 kilowatt plant to be built by Metropolitan Edison Company of Pennsylvania. A system of similar size was purchased by Jersey Central Power & Light Company in February of this year.

B&W's Canadian subsidiary—Babcock-Wilcox and Goldie-McCulloch Limited—is also active in the field of nuclear energy. It built the heat exchanger used in Canada's Nuclear Power Demonstration Reactor at Chalk River, Ontario. It also has been awarded a contract for four 500 megawatt steam generators for the nuclear power station being built at Pickering, Ontario, by the Ontario Hydroelectric Commission. In addition, it is supplying six steam generators for the Karachi Nuclear Power Plant in West Pakistan.

Because of the great diversity of its divisions and products, B&W is in the unique position of being able to not only design and erect 100 per cent of a nuclear steam system, but can fabricate over 80 per cent of all the equipment in our own shops.

I have sketched for you how the search for technological excellence has led Babcock & Wilcox into broad product areas so that it is today a major diversified supplier of industrial equipment, and of goods for use in consumer products. It has more than



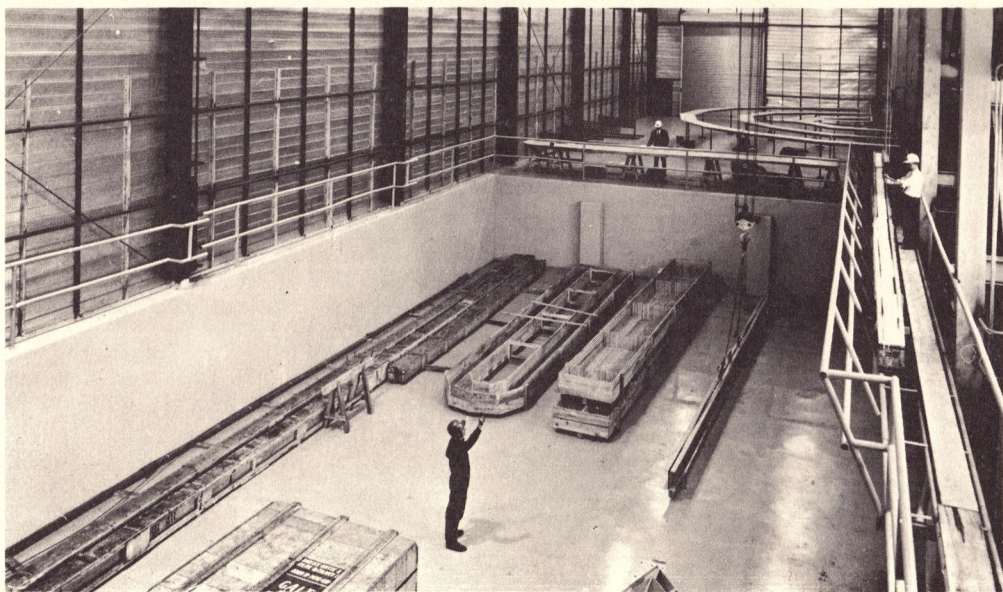
B&W is supplying two nuclear steam supply systems for Duke Power's Oconee nuclear station on Lake Keowee in South Carolina. They will have a combined output of 1,680,000 kilowatts. An 840,000 kilowatt nuclear system is being supplied to the Metropolitan Edison Company in Pennsylvania, and one of similar size is being furnished to Jersey Central Power & Light Company.

30,000 employees, operates 30 facilities in the United States and abroad and had sales of \$562,000,000 in 1966.

In the past ten years we have spent nearly \$175,000,000 to expand facilities, integrate operations, broaden our product lines, and maintain high levels of quality and efficiency in our manufacturing operations. Our expenditures for research and development are approximately \$15,000,000 per year—an amount equivalent to about 25 per cent of our operating income.

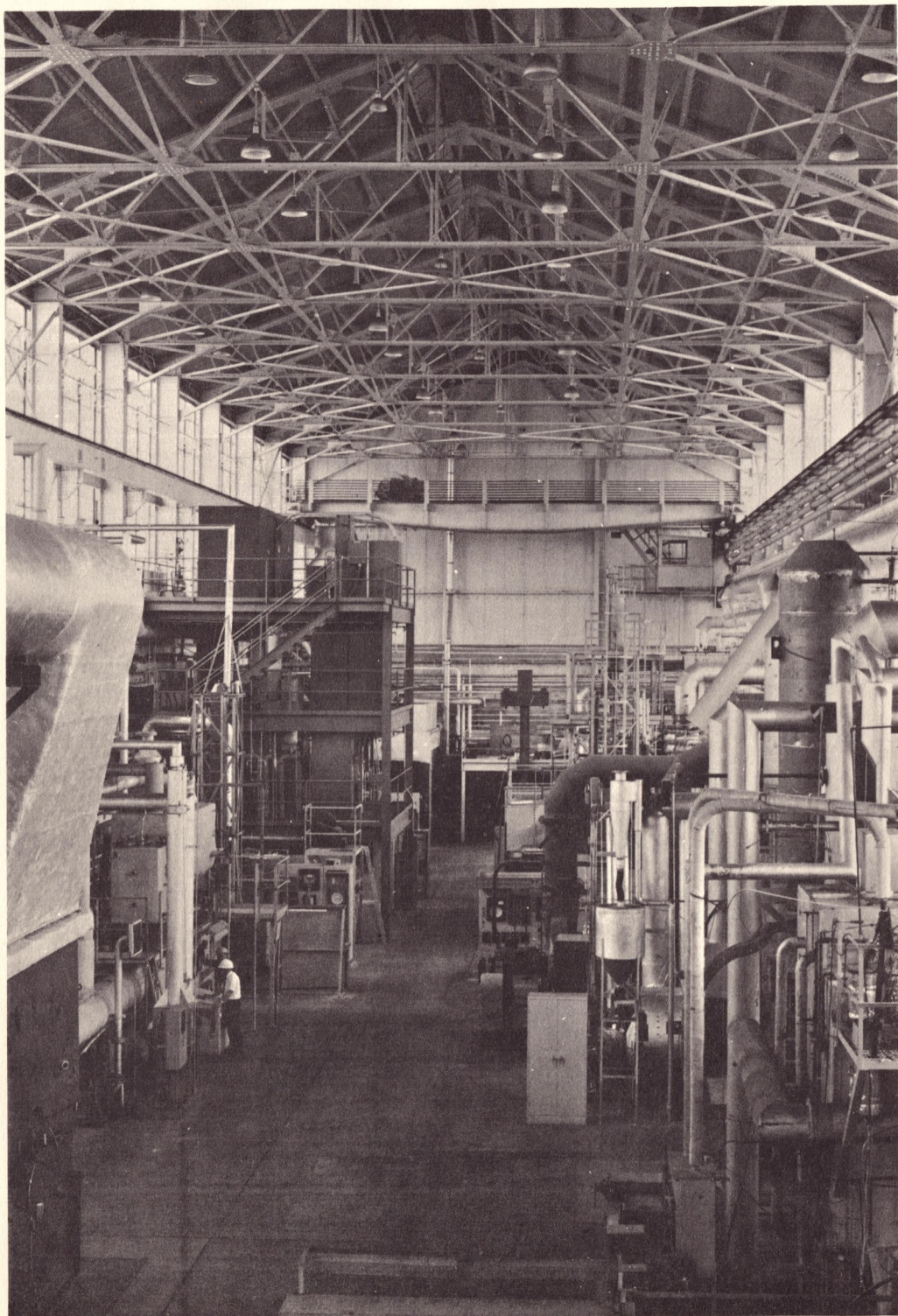
I would like to say a word about the financial management of the Company. The men who were the technological pioneers in B&W were also profoundly aware of the need for efficient, profitable operation. They took many risks—but the risks were in proportion to the Company's financial abilities. They knew that without an adequate return on investment to pay stockholders for the use of their money, to hire capable people, to finance improvements in productive facilities, and to plow back into research and development, the Company would not be able to grow.

B&W has insisted upon giving its customers the highest quality



Babcock-Wilcox & Goldie-McCulloch Ltd.—B&W's Canadian subsidiary—is a leading producer of steam-generating equipment, nuclear components, and other industrial products.

Starting with its formation in 1867, B&W has always devoted a large share of its income to research and development. Shown below is one of the experimental testing bays at the Alliance, Ohio, Research Center.



of service and product, and has always sought to earn a fair return on its investment. Mr. E. H. Wells, B&W's president from 1898 to 1919 used to say, "We do not want all of the business that offers, but we do want a good portion of the cream of it."

As a result of good financial management, the Company has a profitable record and—with the sole exception of 1939—dividends have been paid every year from the initial incorporation in 1881 to the present time. A good share of the profits earned have been reinvested in the business. The Company's net worth as of December 31, 1966, was \$263,000,000. All but \$19,000,000 of that sum represents money internally generated.

The B&W story is a uniquely American story. It is a story of dedicated people working in a free economy to advance the welfare of the entire nation. Many other companies have prospered and grown in that same manner. B&W looks to the future with the full realization that we will face as many problems as we have faced in the past and that they will undoubtedly be more complex and challenging. We are prepared to meet them. So long as we continue the search for excellence started by our founders, we are confident we shall continue to grow and prosper.

This Newcomen Address, dealing with the history of The Babcock & Wilcox Company, was delivered at a National Newcomen Dinner of The Newcomen Society in North America, held at New York, N.Y., U.S.A., on February 16, 1967. Mr. Lewis A. Lapham, Mr. R. E. McNeill, Jr., Mr. William I. Spencer and Mr. Samuel H. Woolley were the hosts at the reception to meet Mr. Nielsen, the guest of honor. Mr. Nielsen was introduced by Charles Penrose, Jr., President of the Newcomen Society in North America, who also presided at the meeting.



THE NEWCOMEN SOCIETY *in North America*

IN APRIL, 1923, the late L. F. Loree (1858-1940) of New York, then dean of American railroad presidents, established a group now known as "American Newcomen" and interested in Material History, as distinguished from political history. Its objectives center in the beginnings, growth, development, contributions, and influence of Industry, Transportation, Communication, the Utilities, Mining, Agriculture, Banking, Finance, Economics, Insurance, Education, Invention, and the Law—these and correlated historical fields. In short, the background of those factors which have contributed or are contributing to the progress of Mankind.

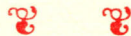
The Newcomen Society in North America is a non-profit membership corporation chartered in 1961 under the Charitable Law of the State of Maine, with headquarters on North Ship Road, Uwchlan Township, Chester County, Pennsylvania, some five miles east of Downingtown, Pennsylvania, and 32 miles west of the City of Philadelphia. Here also is located The Thomas Newcomen Memorial Library in Business History, a reference collection, including microfilm, open to the public for research and dealing with the subjects to which the Society devotes attention.

Meetings are held throughout the United States of America and across Canada at which Newcomen Addresses are presented by leaders in their respective fields. These manuscripts represent a broadest coverage of phases of Material History involved, both American and Canadian.

The approach in most cases has been a life-story of corporate organizations, interpreted through the ambitions, the successes and failures, and the ultimate achievements of those pioneers whose efforts laid the foundations of the particular enterprise.

The Society's name perpetuates the life and work of Thomas Newcomen (1663-1729), the British pioneer, whose valuable contributions in improvements to the newly invented Steam Engine brought him lasting fame in the field of the Mechanic Arts. The Newcomen Engines, whose period of use was from 1712 to 1775, paved a way for the Industrial Revolution. Newcomen's inventive genius preceded by more than 50 years the brilliant work in Steam by the world-famous James Watt.

The Newcomen Society in North America is affiliated with The Newcomen Society for the Study of the History of Engineering and Technology, with offices at The Science Museum, South Kensington, London, S.W. 7, England. The Society is also associated in union with the Royal Society for the Encouragement of Arts, Manufactures and Commerce, whose offices are at 6 John Adam Street, London, W.C. 2, England.



Members of American Newcomen, when in Europe, are invited by the Dartmouth Newcomen Association to visit the home of Thomas Newcomen at Dartmouth in South Devonshire, England, where the festival of "Newcomen Day" is celebrated each year on the fourth Friday in July.



*"The roads you travel so briskly
lead out of dim antiquity,
and you study the past chiefly because
of its bearing on the living present
and its promise for the future."*

—LIEUTENANT GENERAL JAMES G. HARBORD,
K.C.M.G., D.S.M., LL.D., U.S. ARMY (RET.)
(1866-1947)

*Late American Member of Council at London
The Newcomen Society
for the study of the history of
Engineering and Technology*

